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ABSTRACT

Part of a series of eight student learning modules in vocational agriculture, this booklet deals with evaluation of livestock. It contains sections on carcass evaluation, the evaluation of performance and production, and the design of livestock production facilities. Each of the first two sections has a glossary, and all three conclude with a quiz. (PLB)

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CARCASS EVALUATION

Several methods may be used to evaluate livestock carcasses, but the most accurate method is through the use and application of the *USDA Official Standards for the different species and classes of livestock carcasses. Since the evaluation of beef, swine, and sheep carcasses, using the official standards as a basis, are discussed in detail in the V.A.II student materials, Topic II-E-2, this method of evaluation will not be repeated in this topic. This topic concerns the establishment of the official standards, how U. S. grades may be used by consumers and the packing and processing industries, and the purposes and benefits of meat inspection.

I. INTRODUCTION

Tentative grading standards were used by the armed services in the purchasing of beef during World War I. The Federal Meat Grading Service was established in 1925 by the Sixty-eighth Congress; however, it was 1926 before the first official standards were adopted for the grading of beef. Official grade standards were established and adopted for lamb and mutton in 1931; and in the same year, tentative standards were established for pork.

Official standards for all species and classes of livestock carcasses and wholesale cuts have been revised several times. Revisions to the standards for a particular class usually reflect a change in the quality of meat demanded by the consumer and type of animal produced.

Federal grades provide the consumer with a reliable guide to quality. Each grade has specifications which must be met in order for the carcass to receive that grade stamp. Also, the standards require that a carcass have a certain degree of quality. Quality refers to tenderness, juiciness, and flavor. Meats of different quality must be prepared differently. The grade indicates to the knowledgeable consumer the manner in which the meat should be prepared. The grade stamp that appears on meat, therefore, can be used in two ways by the consumer: (1) as a quality guide, and (2) as a guide for preparation. All grades of meat can be made appetizing if properly prepared.

In order to take advantage of the different grades of meat, the consumer must be familiar with the quality of each grade. There is a variation in quality among the grades and a considerable difference from the top to the bottom grade in a particular class.

Federal meat grading is administered by the Agricultural Marketing Service, U. S. Department of Agriculture. Federal graders receive Civil Service Commission appointments, are of high integrity, and must complete an intensive training program. Cost of grading meat is borne by the firm (slaughter plant or dealer) requesting the service. The stamp used by each grader identifies the grader. Certain letters of the alphabet which form a code appear on each grader's stamp. The grade is applied to the meat with a roller stamp which leaves its mark the full length of the carcass, or if cuts are being graded, the full length of the cut.

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The number of livestock carcasses being federally graded is increasing, but most of the carcasses are sold as nongraded. It is expected that more beef carcasses are graded than other species of livestock carcasses, with the exception of poultry. However, during the first seven months of 1975, only 41 percent of the beef produced was actually graded. Of the beef graded during this period, 96 percent of it graded Prime, Choice, or Good. This indicates that most of the graded carcasses were from fed beef.

Much of the meat produced by the lower grade carcasses is used as ground meat for hamburger, or in a mixture for prepared meats, such as sausage. There is not an advantage to either the packer or consumer in grading the carcasses that supply the meat for these products.

* All underlined words are defined in the Glossary of Terms.

II. MEAT INSPECTION

Meat inspection is for the purpose of keeping it wholesome and fit for human consumption. Slaughtering plants, as well as meats, are inspected to insure that the equipment and facilities are clean and sanitary and the meat is properly handled.

The Meat Inspection Act was passed on June 30, 1906. Prior to its passage, a voluntary, limited form of inspection was conducted. Only cattle and hog carcasses intended for export were inspected. The original Act has undergone improvements over the years. A recent revision was the Wholesome Meat Act of 1967. This Act stipulated that states must establish meat inspection systems equal to the Federal system. Before the 1967 Act, Federal inspection applied only to meat and meat products in interstate or foreign commerce. Meat inspection systems among the states varied, and some states did not have a meat inspection system.

With the passage of the 1967 Act, states were given until December 15, 1970, to initiate a system and train inspectors; otherwise, the Federal inspection system would take over meat inspection within the state. Some states complied with the Act, while in others the Federal system and inspectors are responsible for inspection. The Animal and Plant Health Inspection Service (APHIS), U. S. Department of Agriculture, is responsible for the Federal inspection of meat, poultry, and plants processing foods.

To comply with the Wholesome Meat Act, 500 people in Texas were trained and employed to inspect slaughtering plants. In 1971, there were 748 plants in the state being inspected.

Exemptions were provided in the Act for individuals having animals slaughtered for use by their family and guests. It allowed processors to slaughter animals for individuals; however, the meat must be kept separate from the carcasses slaughtered for retail sales.

Functions performed by the Federal inspection system are as follows:

1. Inspection of meat and poultry selling in interstate and foreign countries;
2. Inspection of all meat and poultry products in slaughtering plants not having a state inspection system comparable to Federal inspection;
3. Review programs established by states and making sure states comply and maintain satisfactory inspection programs;
4. Review foreign inspection systems and packing plants that ship meat, poultry, and their products into the U. S. These products are also inspected at port of entry and must meet the same standards as those produced in the U. S.; and
5. Inspect plant facilities, equipment, sanitation, slaughter, methods of processing, and containers and labeling.

A stamp similar to the one shown at left is placed on meat passing inspection. The stamp has an abbreviated form of "U. S. Inspected and Passed" and a number on it. The number on the stamp is assigned to only one slaughter plant. Since the stamp appears only on the wholesale cuts, the consumer will not be able to observe the stamp on the retail cuts.

A fluid consisting of harmless vegetable coloring is used for stamping meat. The same fluid is used to apply the quality and yield grades and packer brands or trade marks to carcasses and wholesale cuts.

All Federally inspected prepackaged meats will have a label similar to the one at right. This includes soups, spreads, and other meat products.

All fresh and frozen and processed poultry products will have a mark, label, or metal tag similar to the one at left.

State inspection stamps are similar to the Federal stamp. It also has an abbreviated form of "Inspected and Passed," a number which is assigned to a specific plant, and the words or an abbreviation of the words, "Department of Agriculture."

The Meat Acceptance Service is another important function of the Federal Meat Grading Service. The Service assists organizations, such as governmental agencies, private institutions, and other purveyors of meat in two ways: (1) developing specifications for meat purchases, and (2) the examination of products to assure they comply with the specifications.

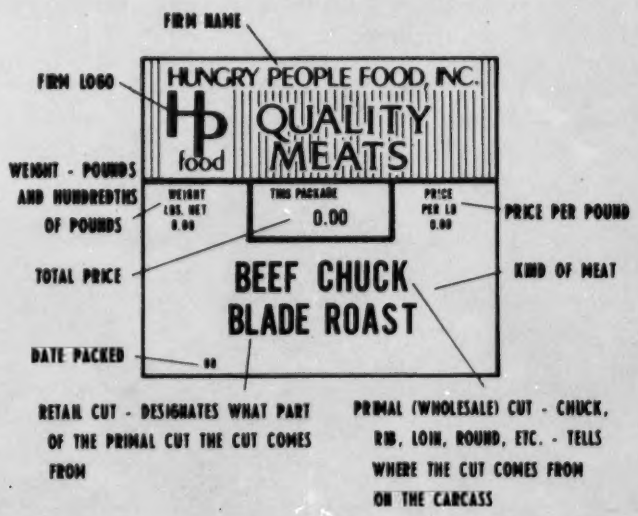
Firms using the Service purchase meat or meat products based on the USDA Institutional Meat Purchase Specifications. Specifications are available for a number of items. Copies may be purchased from the Government Printing Office.

To use the Service, the purchaser requests suppliers to submit bids on products based on IMP specifications. The supplier receiving the contract contacts a Federal meat grader and requests that examination be made of the products. The grader is responsible for accepting the products and certifies that they meet specifications. Each item or carton is stamped with a stamp similar to the one in the illustration, and the purchaser is provided with an official certificate containing information about the product. Procuring meat by this method assures the purchaser or firm that the grade, trim, and weight requested is adhered to.

III. UNIFORM RETAIL MEAT IDENTITY STANDARDS

With the assistance of the White House Office of Consumer Affairs, USDA, and the Council of Better Business Bureaus, a committee of retail grocers, meat packers, and others was formed for the purpose of standardizing retail meat cuts and their names over the entire U. S. The committee established a Uniform Retail Meat Identity Standards for the cutting and labeling of meat. A sample label used by a grocery firm is shown.

LABEL USED BY GROCERY FIRMS
(RETAIL MEAT IDENTITY STANDARDS)


FIRM NAME
HUNGRY PEOPLE FOOD, INC.
FIRM LOGO
HP food
QUALITY MEATS
WEIGHT - POUNDS AND HUNDREDTHS OF POUNDS
WEIGHT LBS. OUT 0.00
THIS PACKAGE 0.00
PRICE PER LB 0.00
PRICE PER POUND
TOTAL PRICE
BEEF CHUCK BLADE ROAST
KIND OF MEAT
DATE PACKED
RETAIL CUT - DESIGNATES WHAT PART OF THE PRIMAL CUT THE CUT COMES FROM
PRIMAL (WHOLESALE) CUT - CHUCK, RIB, LOIN, ROUND, ETC. - TELLS WHERE THE CUT COMES FROM ON THE CARCASS

IV. FEDERAL GRADES, PACKER BRANDS, AND AGING OF MEATS

Both quality and yield grades appear on all beef carcasses and wholesale cuts that have been graded by Federal graders. Examples of the stamps used for a Choice quality grade and a U. S. No. 1 yield Grade beef carcass are shown below:

Other quality grade and yield grade stamps are similar to the ones shown above.

Federal grades for beef, veal, lamb, and pork are shown in the following chart:

Beef		Veal	Lamb	Pork
Quality	Yield			
Prime	No. 1	Prime	Prime	U. S. No. 1
Choice	No. 2	Choice	Choice	U. S. No. 2
Good	No. 3	Good	Good	U. S. No. 3
Standard	No. 4	Standard	Utility	U. S. No. 4
Utility	No. 5	Utility	Cull	Utility
Cutter		Cull		
Canner				

Much of the pork, especially those cuts that are cured, are given a packer brand. The packing firm establishes quality standards which the product must meet before it may carry the packer's brand. Products not meeting the packer's standard are sold as nongraded. Packer brands are usually reliable indicators of quality.

Aging

Generally only high quality ribs and loins of beef and lamb are aged. However, some individuals have the entire carcass aged by custom slaughterers.

Meats are aged to further develop their tenderness and to give them a characteristic flavor. In order to be aged, the meat must have a thick covering of fat. This prevents the lean from becoming discolored and keeps evaporation at a minimum. The most widely used methods of aging are as follows:

(1) Vacuum packaging - By this method, the meat is placed in a moisture proof film and kept in the film until it reaches the customer. Weight losses due to moisture evaporation and surface spoilage are reduced by this method. The meat is kept in the package for two to three weeks.

(2) Fast aging - The meat is held at a temperature of about 75 degrees Fahrenheit and a humidity of 85 to 90 percent for one or two days when this method is used. The meat is placed under an ultraviolet light to reduce the microbial population.

(3) Dry aging - The meat is stored for three to six weeks at a temperature of 34 to 38 degrees Fahrenheit. The humidity in which the meat is stored varies with the processor. Some prefer a relatively low humidity for storage, while others want the humidity to be 85 to 95 percent. The higher humidity increases mold development on the outer surface and reduces moisture losses in the meat.

GLOSSARY OF TERMS

1. Classes - Refers to the sex and age of animals. Examples of classes would be steers and heifers.

2. Purveyors - Firms or individuals providing or selling meats. They may or may not be a packing plant.

3. Species - Categories of individuals (animals) having common names. They are below the genus, and each category is capable of interbreeding.

4. USDA Official Standards - These are specifications established by the USDA for each grade within each class for livestock, livestock carcasses, wholesale cuts of meat, and other agricultural products.

SELECTED STUDENT ACTIVITIES

1. Two reasons for aging meats are (1) _____ and (2) _____.

2. Packer brand standards are established by the _____.

3. Packer brands are usually _____ indicators of quality.

4. Less _____ (kind of meat) is graded than other kinds of meats.

5. Both _____ and _____ grades appear on all graded beef.

6. The Meat Acceptance Service provides two services: (1) _____ and (2) _____.

7. Uniform Retail Meat Identity Standards were established for the purpose of _____ _____.

8. State meat inspection stamps are similar to the _____ stamps.

9. Inspected meats can be traced to the plant in which they were slaughtered by the _____ on the _____.

10. Most graded beef is in the top three grades, which are _____, _____, and _____.

11. Less than _____ percent of the beef slaughtered is Federally graded.

12. The grader grading meat may be identified by the _____ used on the meat.

13. The grade stamp appearing on meat serves the consumer in two ways: (1) as a guide to_____, and (2) _____.

14. Quality refers to _____, _____, and _____.

15. List three functions of Federal meat inspectors:
    a.
    b.
    c.

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PERFORMANCE AND PRODUCTION TESTING

1. PRODUCTION TESTING

Since estimates based on visual appearance are inaccurate, livestock producers must have an accurate method of estimating the productive performance of livestock. Valid production testing data can be used by the livestock producer in the identifying and selection of high producing animals. Because producers have recognized the value of production tests, the number of animals being placed in testing programs is increasing. Presently tests are being conducted by breed associations, state universities, commercial firms, and individuals. The reputation of the firm conducting the test should be considered by the breeder when reviewing test results.

The three principal reasons for establishing livestock testing programs are to increase production, efficiency, and improve quality. Progeny and performance testing are the two kinds of production testing. *Progeny tests are tests conducted on the offsprings of an animal. This is the best method for testing heritability traits. Progeny tests normally include the factors considered in a performance test plus many other factors. Performance tests are usually conducted on male animals and involve such traits as daily gains, feed conversion, growth rate, and grade. The tests are based on a specific number of days.

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2. PROGENY TESTING

Factors influencing progeny testing are discussed below:

Heritability of Traits

Since the heritability of a trait affects improvement in livestock more than any other factor, it is important that livestock producers have knowledge of the heritability of different traits. The heritability of a trait also affects the rate of improvement for a particular trait.

An inherited trait which is affected only slightly by the environment is said to be highly heritable. An example of a very highly heritable trait is the color of a black sheep. Since environment has little effect on the black color, it is 100 percent inherited. Most traits are not as highly heritable as the black color of sheep. In fact, a trait that is 50 percent or more heritable is rated as being highly heritable. Traits with less than 50 percent heritability are rated from medium to low heritability. Some traits, such as daily gains in cattle, are influenced by nutrition, parasites, and other factors. The percentage of the inheritance of these traits is estimated.

HERITABILITY ESTIMATES

Trait	Beef Cattle %	Dairy Cattle %	Swine %	Sheep %
Birth Weight	45	45	5	30
Wool Face Covering	-	-	-	50
Daily Gain	46	-	30	30
Staple Length	-	-	-	45
Feed Efficiency	39	50	30	-
Milk Production	30	25	-	30
Backfat Thickness	-	-	50	-
Weaning Weight	26	-	15	30
Body Capacity	-	23	-	-
Slaughter Grade	38	-	-	-
Percent Ham	-	-	60	-

* All Underlined terms are in the Glossary of Terms.

Environmental Influence

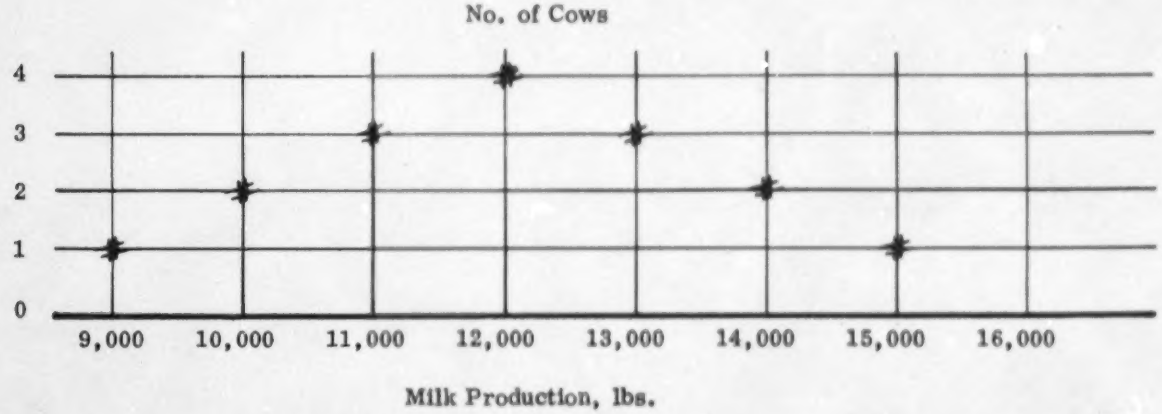
All animals possess certain traits that are influenced by the environment. Only animals raised, tested, or fitted under similar conditions should be considered when there is a possibility that the trait(s) will be influenced by the environment.

An example of an environmental influence is the moving of cattle from a temperate to a tropical or subtropical area. These cattle tend to degenerate and become unproductive. Cattle moved from a temperate zone show signs of distress when the temperature reaches 85 degrees Fahrenheit.

Selection Differential

Within any test group of animals there will be some variation. A few animals in the group will perform exceptionally well, while others will perform at the lower end of the scale. Most animals within a group will have only average production, or will produce at an intermediate level. If the high performers are selected out of a group, the difference in their production and the average production of the group is the selection differential. The fewer the number of animals selected from a group, the greater the selection differential will be.

An example of selection differential based on the milk production of a group of cows is given. The selection differential would be similar for a number of traits.



In the group of 16 dairy cows used in the example, one produced 9,000 lbs., two produced 10,000 lbs. three produced 11,000 lbs. etc. The average production of the cows in the group is 12,000 lbs. (total production divided by the number of cows). A majority of the cows is producing within 1,000 lbs. of the average production of the group. If the animals having average production are bred to a bull that transmits 12,000 lbs. of production, then the offsprings would be expected to produce at about the same level. There would be no genetic progress in this mating.

Using selection differential to make genetic progress, the better half of the dairy cows within the group would be selected and the other half disposed of. The average milk production of the best eight cows is 13,250 lbs. The difference between the original herd average and the selected herd average is 1,250 lbs., the selection differential.

The average offspring from the cows in the selected group would be expected to produce more milk than the original herd average, but not 1,250 lbs. more. Since milk production is only about 25 percent heritable, about 25 percent of the 1,250 lbs. would be passed on to the offsprings. However, some of the offsprings would produce more.

The greater the difference (selection differential) between the selected animals and the original herd average, the greater the progress will be. Also, the more variance in the animals in a herd, the more likely the herd average can be increased.

Number of Traits as a Basis for Selection

Genetic improvement is much easier and faster when selection is based on a relatively small number of traits. There is a steady decline in progress as more traits are used as a basis for selection. Assuming one trait as 100 percent progress, the following rates of progress can be expected when selection is based on more than one trait: two traits, 70 percent; three traits, 58 percent; four traits, 50 percent; and five traits, 45 percent.

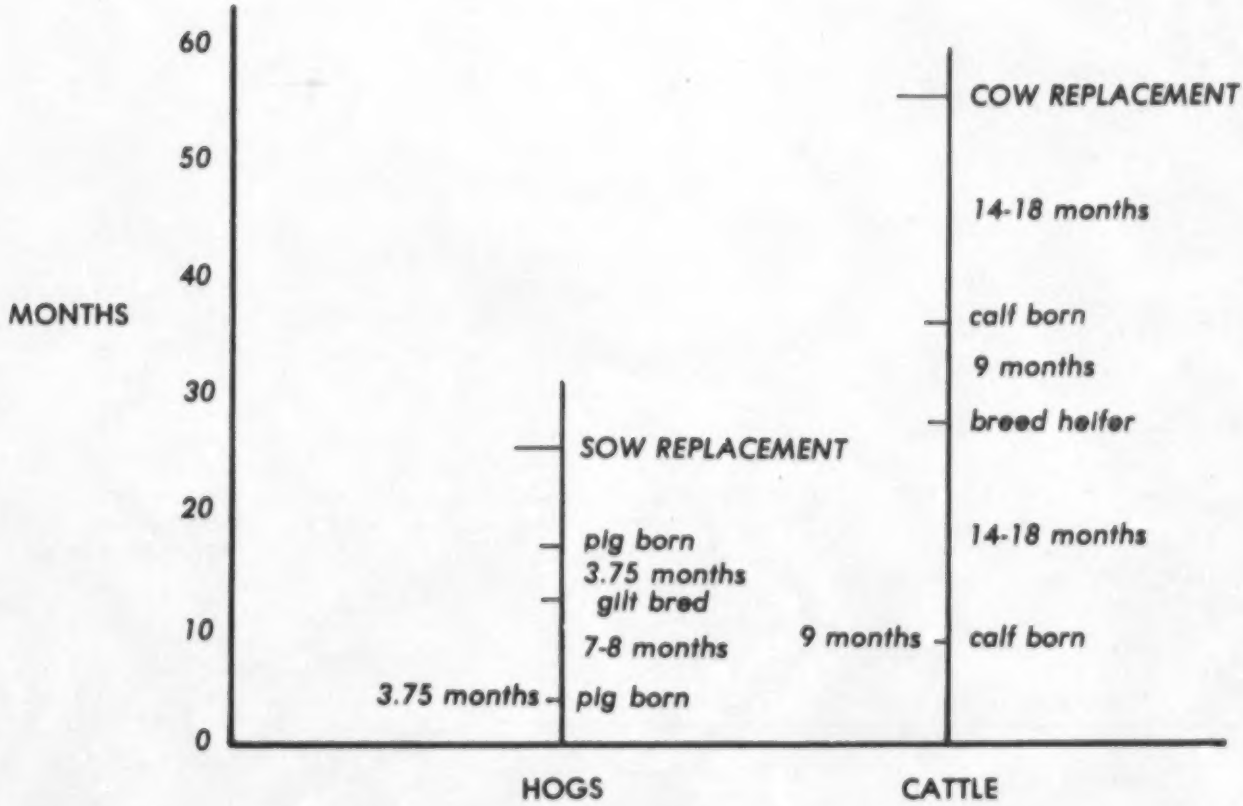
Animals possess both beneficially related (complimentary) and detrimentally (negative) related traits. The selection of animals based on one trait will often either improve or cause deterioration in another trait. Daily gains and backfat, related traits in swine, may be used as an example. Swine having a high daily gain will produce more backfat than is desirable. Cattle breeders are fortunate in that cattle have more beneficially related traits than other species of livestock. Two beneficially related traits in cattle are rate and efficiency of gain. Selecting cattle on rate of gain, one could expect an improvement in the efficiency of gain. In fact, every .25-pound increase in a steer's gaining ability improves feed efficiency .11 percent.

Generation Interval

The generation interval is the time normally required to replace the average animal in a herd or flock. Genetic change requires about the same length of time.

Generation interval and production lag, a term used by market analysts, are closely related. Both are caused by biological factors (the time from breeding to birth and time required for maturity).

GENERATION INTERVAL



If only the best of each succeeding generation were kept in a breeding herd, the generation interval could be a much shorter period; but it is not possible or practical to dispose of all other generations when a new generation becomes available. The normal generation intervals for the different species of livestock are beef cattle, 5 years; dairy cattle, 4 years; sheep, 4 years; and swine, 2 years.

Number of Offsprings

The more individuals there are to select from the more progress that can be made.

It is evident after reading the above information that the speed in which genetic progress can be made through selection is influenced by heritability of a trait, selection differential, the number of traits selected, and generation interval. Using three of these factors, animal scientists have developed a formula or equation that may be used to determine the amount of progress that can be expected for each generation:

% Heritability x Selection Differential x Factor for Number of Traits

An example using the formula is given below: It is assumed that the daily gain is 46 percent heritable, and a group of selected animals is gaining one-half pound per day more than the average animal in the herd. It is also assumed that equal emphasis is being placed on the selection of another trait. Progress is only 70 percent as great when selection is for two traits.

$$.46 \times .50 \times .70 = .16$$ progress in daily gain in next generation.

The same formula may be used to estimate the annual progress with a generation interval of five years.

$$\frac{.46 \times .50 \times .70}{5} = .032$$ progress in daily gains expected each year

3. TYPES OF SELECTION

There are three types of selection. These are one trait (often referred to as tandem selection), independent culling, and net merit. An explanation of each type is given:

One Trait or Tandem Selection

A breeder using this type concentrates on one trait until a certain level of performance is reached, then emphasis is placed on a second trait. Disadvantages of this type are animals with extremely poor traits will be selected for replacements; and when emphasis is placed on the second trait, the original trait regresses. The latter statement is particularly true if the traits are negatively correlated.

Independent Culling

This is a much better method than tandem selection because a standard for each trait is established. An animal not meeting the standard for a particular trait is culled regardless of the superiority of the other traits. Considerations that should be remembered when using this type are (1) traits should be of equal importance for best results; (2) improvement is in more than one trait at a time and is much faster; and (3) this method does not allow a slightly substandard performance in one trait to be offset by a performance greatly above the minimum established in another trait.

Net Merit Selection

Credit is given for a specific level of merit for each of the most important traits. The animals in the group receiving the highest net score are selected. This method is the best and most effective for making overall herd improvement.

Procedures for using this method are listed below:

1. Determine traits that will be basis for selection;
2. Establish value of each trait; and
3. Calculate the value of each trait passed to the offspring.

Dairy cattle breeders often base selection on milk production and body type. These two traits are used in an example. The production and body score of two dairy cows are as follows:

Cow No.	Production	Type Score
1	13,500 lbs.	85
2	12,500 lbs.	89

In step number 2, the value for each trait must be established. The value of milk production is easily determined, since milk is sold by the pound. The market price of milk can be the value for this trait. It is assumed milk is selling for $10.50 per hundred weight.

Cow No.	Production	Value of Trait
1	13,500 lbs.	$1,417.50
2	12,500 lbs.	$1,312.50

The value of type score is more difficult to determine, as type score may mean different things to different dairy cattle breeders. However, a cow with a higher type score may be more valuable because she is easier to milk, or more valuable if she is to be sold to another producer. The breeder will have to establish the value of type score. In the example the type score is given a value of $12.50 per unit.

Cow No.	Type Score	Value of Type Score
1	85	$1,062.50
2	89	$1,112.50

When the two traits are totaled (Cow No. 1, $2,480.00; Cow No. 2, $2,425.00), cow number 1 has a $55 advantage in net merit. The third step, No. 3, is to calculate the value of each trait passed on to the offspring. To do this, the heritability and selection differential must be determined. This must be determined from herd averages. It is assumed that the herd production average is 11,500 lbs., and the average type score is 80.

Cow No. 1

Milk Prod.	Herd Ave.	Selection Differential		Heritability	Genetic Increase		Value Per Unit	Value Increase
13,500 lbs.	11,500 lbs.	2,000 lbs.	x	.25 =	500 lbs.	x	10.50 =	$52.50
Type Score								
85	80	5	x	.30 =	1.5	x	12.50 =	$18.75
							Net Merit	$71.25

Cow No. 2

Milk Prod.	Herd Ave.	Selection Differential		Heritability	Genetic Increase		Value Per Unit	Value Increase
12,500 lbs.	11,500 lbs.	1,000 lbs.	x	.25 =	250 lbs.	x	$10.50 =	$26.75
Type Score								
89	80	9	x	.30 =	2.7	x	12.50 =	$33.75
							Net Merit	$59.90

Cow number 1 would be more valuable than cow number 2 based on the value of the traits used in examples.

A summary of principal factors on net merit selection is given below:

1. It permits overall improvement in the merit of animals but less improvement in each trait than when selection is based on one trait;

2. Heritability and economic values are of major importance in determining the traits to serve as a basis for selection;

3. The value of each trait depends on market demands and varies with the goals of the breeder;

4. Genetic relationships should be considered; and

5. Performance slightly below the established standard in one trait may be offset by outstanding performance in another trait.

4. PERFORMANCE TESTS

As stated in the introduction, performance tests are usually conducted on male animals. The reasons for this are the better performing males are selected as herd sires and the bases for selection (weaning weight, growth rate, and carcass grade) are highly heritable. Because test results are fairly easy to evaluate, examples of completed tests are not shown.

Performance tests are a means of improving livestock; however, they are not a "cure-all" for the producer's problems. Other factors which should be considered are listed below:

1. The breeder must have clearly-defined, established goals;

2. Good production practices must be used in any improvement program;

3. The producer's decisions will be influenced by the kind of animals being bred, (purebred or grade);

4. Sex is always a factor in selection;

5. Present breeding in herd; and

6. Size of herd.

GLOSSARY OF TERMS

1. Performance Tests - Tests to determine the performance of certain characteristics (usually growth factors) in animals.

2. Progeny Tests - Tests to determine the heritability traits of the offsprings of an animal.

SELECTED STUDENT ACTIVITIES

1. Circle the T if the statement is true, or the F if the statement is false.

T F a. Trait value depends on market demand.
T F b. Heritability of a trait is more important than economic values.
T F c. The more individuals there are to select from, the more genetic progress that can be made in a herd.
T F d. There is a steady decline in progress as more traits are used as a basis for selection.
T F e. Performance tests are only one means of improving livestock.
T F f. A trait that is 40 percent heritable is rated as being highly heritable.

2. Complete the following sentences.

a. The best and most effective method for making overall improvement in livestock is the _____ _____ method of selection.

b. Four factors affecting the speed of genetic progress by selection are (1) _____, (2) _____ _____, (3) _____ _____, and (4) _____ _____ selected.

c. Generation interval is the time required to replace the _____ _____ in the herd.

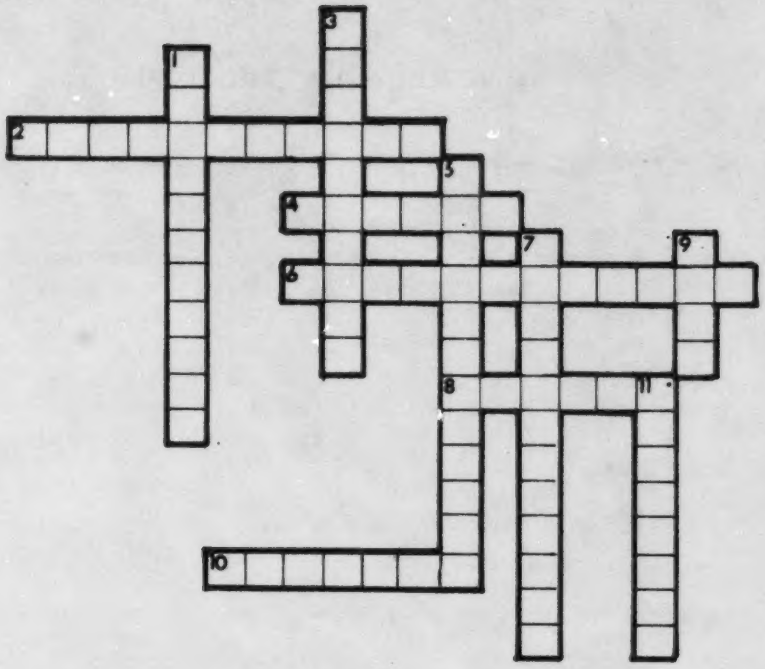
d. A _____ percent rate of progress can be expected when selection is based on two traits.

3. Use a formula or equation to determine the progress made in the next generation for daily gains if it is 50 percent heritable, equal emphasis is placed on another trait, and a group of animals is gaining .75 of a pound per day more than the average animals in the herd.

4. What is selection differential?

5. How do environmental influences affect the selection of livestock?

6. Crossword Puzzle



Down:

1. Tests which are usually conducted on males to determine daily gains, feed efficiency, growth rate, etc.
3. The interval required to replace the average animal in a herd or flock.
5. Related traits which are both improved when selection is based on one of them.
7. A factor affecting improvement in livestock more than any other factor.
9. The sex of animals used for performance tests.
11. Values in addition to heritability that should be considered in the selection of animals.

Across:

2. A factor in addition to heritability that influences genetic progress.
4. The term used for a selection type based on one trait.
6. The difference between the original herd average and the selected herd average.
8. A specie of livestock which has a large number of beneficially related traits.
10. A test to determine the heritability of offsprings.

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PLANNING LIVESTOCK FACILITIES

1. IMPORTANCE OF GOOD FACILITY PLANNING

The owner or manager of any livestock operation must make use of all available management tools to compete in the complex field of livestock production. Livestock facilities are some of the most important management tools and must be thoroughly and carefully planned before beginning construction. A profitable operation is normally an efficient one, and it is almost impossible to have an efficient operation without prior planning. This includes consideration of long-range as well as immediate needs.

Good managers are constantly seeking ways to improve and increase the efficiency and volume of business. This requires changes in facilities in many instances. These changes will be much easier to make when they have been anticipated and included in the original plan.

A livestock facility should permit the efficient production of livestock and animal products in a minimum length of time and with a minimum of labor. Facilities deficient in these areas will reduce profits and cause unnecessary labor.

2. PLANNING LAND REQUIREMENTS

When determining the land requirements for an efficient livestock enterprise several factors should be considered. A discussion of each factor is given.

Location

A basic requirement for the livestock enterprise is selecting a location. Land area and location often influence production and profits. Some factors to consider are as follows:

1. Roads - The land area should be located adjacent to good all-weather roads. A successful enterprise will require the transporting of a large volume of supplies and commodities. If public roads are available, this will prevent the producer's having to build them.

2. Available supplies - Feed and other supplies should be available in large quantities.

3. Vicinity - The livestock enterprise should not be located in an area near a city or within an area that is under, or will eventually come under, the jurisdiction of city zoning or sanitation ordinances.

4. Terrain - This is particularly important if the enterprise requires close confinement of animals, such as a feedlot. A feedlot should be located in an area that has from two to five percent slope because mud creates a problem in areas with less than two percent slope. It is usually cheaper to create the desired slope in areas with too much slope rather than pave the feedlot. Feedlots should be located at the top of a drainage area, if possible, to prevent having to drain water from other areas onto the feedlot area. Since south or southeast slopes provide natural protection from winter wind and are exposed to more direct sunlight, the feedlot should be located on one of these slopes if possible. Air and water pollution problems from feedlots can be minimized by proper site selection. Permits from several agencies must be obtained prior to the construction of a feedlot.

Cost

The major investment in some livestock enterprises is in land. If possible, the acquisition of land should be in an area where land and taxes are relatively cheap.

Size of Land Area

The land area must be large enough to support the present scope of the enterprise, plus enough for anticipated expansion. If there is a possibility that the enterprise will eventually require more

space, land needs should be bought with the initial purchase. If the financing is not available for additional land at the time of the initial purchase, the site should be selected in an area where land will be available for purchase or lease.

3. PLANNING BUILDING REQUIREMENTS

Facilities required will depend upon the kind of enterprise, but certain general rules should be adhered to in all cases. Purposes of the structure to be built should be determined. All livestock buildings should provide protective shelter, a controlled environment, and have a low labor requirement. Shelter and environmental control requirements will be dependent upon the climatic conditions of the region. Animals gain more rapidly and on less feed under ideal temperature and humidity conditions. An investment in environmental controls must be in relation to the expected return from the livestock, keeping in mind that there is a point beyond which returns on the investment will begin to decrease. Factors to consider in planning farm buildings are as follows:

Labor Saving Devices

Labor saving devices should be incorporated into all farm buildings. Research has shown that labor requirements for some enterprises can be reduced as much as 80 percent with proper building management and equipment. Four elements affecting the labor requirements are (1) building arrangement, (2) size and location of doors and passageways, (3) interior columns and structural obstructions, and (4) the use of mechanized equipment.

Flexibility

Buildings for general farming and ranching operations should be designed with flexibility in mind. One-story buildings with a maximum of movable partitions have flexibility, as do open sheds. They can be used to house livestock or to store feed and equipment.

Sanitation

Buildings should be constructed so that they are easily cleaned, disinfected, and freed of rodents. Structures that afford entrance of direct sunlight provide for the elimination of excess moisture. Construction that permits operation of a mechanized manure loader and other equipment will make cleaning easier and more economical.

Attractiveness

This is sometimes overlooked in livestock buildings. It is not extremely important from the standpoint of building use and convenience, but it is important in areas such as pride of ownership and sale value of the property. In the case of purebred herds and flocks, attractive buildings have an enormous amount of advertising value.

Space Requirements

Building space requirements will depend upon the class of livestock and type of operation. In general, livestock buildings should be large enough to accommodate the existing herds and flocks, expected young stock, and any expected future expansion of the enterprise.

Lighting and Ventilation

Proper lighting is sometimes overlooked in livestock buildings. Lights may be obtained through open doors and passageways, windows, artificial lights, or sheets of clear plastic roofing material. A combination of the previously mentioned four methods are used in most buildings. The building should be adequately lighted regardless of the methods used.

Ventilation is a very important element in any livestock building. Animals held in close confinement are extremely susceptible to disease, and good ventilation is one way of preventing and reducing disease problems. Moisture and foul odors should be removed with a minimum of temperature variation within

the building and without causing direct drafts. Adequate ventilation may be assured by using open sheds, open doors and windows, building or stall partitions that are left slatted or open at the top, or a system of intake and outtake flues operated by gravity or forced air.

Safety

Livestock buildings should be built with safety in mind - safety for both man and animals. Doors should be of sufficient width and height, and building floors should be constructed of materials that will prevent slippage. All sharp edges and pointed objects should be omitted. Structural safeguards against fire should be incorporated into the structure.

4. PLANNING FENCE AND PEN REQUIREMENTS FOR LIVESTOCK ENTERPRISES

The class of livestock and type of operation will determine the kinds of fences and pens needed. Fences and pens will probably represent a large investment, and mistakes will make them even more expensive and less efficient. Planners of livestock enterprises should select fencing or pen fabric and posts that will last about the same length of time.

Planning Efficient Fences

There are several advantages to planning fences and building them properly, although it is difficult sometimes to measure their financial return.

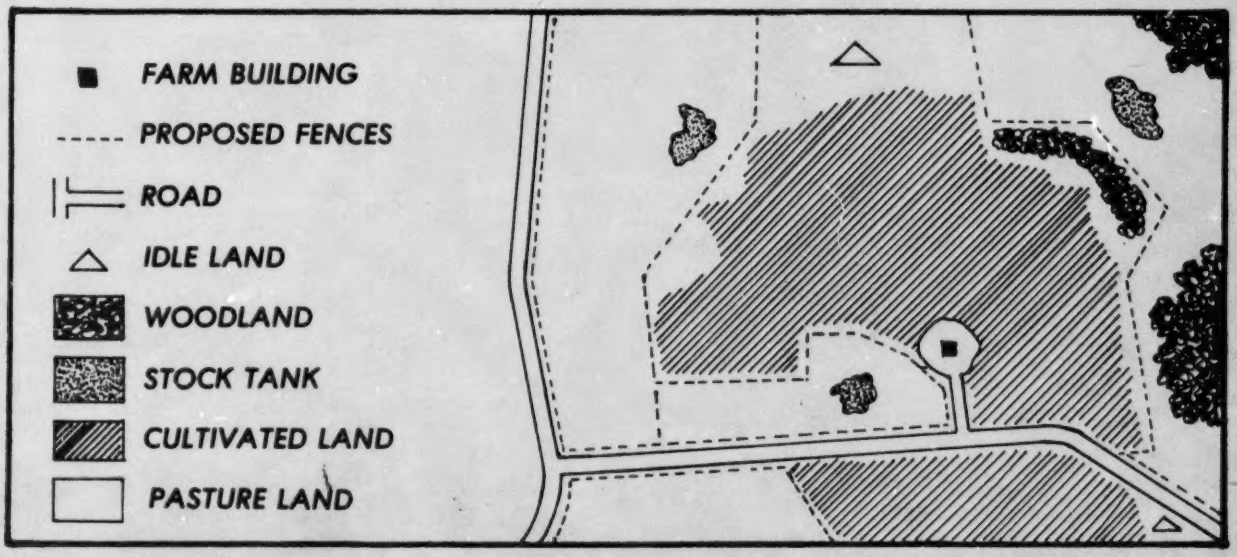
Fences establish permanent boundary lines around property. Cross fences control the movement of livestock and in so doing keep animals separated. Controlled movement of livestock prevents the spread of disease and keeps livestock separated.

Boundary fences keep livestock off highways and roads and out of neighbors' fields and pastures. They also add to the attractiveness of livestock operations when kept in good condition.

Movable or temporary fences may be used in some types of livestock enterprises. They serve well with pasture rotation systems and other operations where livestock are moved frequently or must be kept isolated for short periods of time.

The first step in planning fences is to sketch the layout of the enterprise. If the producer is a cooperator of the local soil conservation district, an aerial map of the area is probably available from the Agricultural Stablization and Conservation Service, which is located in most county seats.

AERIAL MAP OF FARMSTEAD WITH PROPOSED FENCES



After an aerial map of the farm has been secured, proposed fences should be sketched on the map. The following factors should be considered when sketching in the fences:

1. Fences should follow the crest or natural waterline division in a terraced area;
2. Straight fences should be used as much as possible;
3. Fences should be laid out according to land capability classes;
4. Gates and other passageways should be included in sketch;
5. Priority should be given to boundary fences;
6. Convenience and efficiency; and
7. Labor requirements.

Several different kinds of fences may be built. Some are woven wire, barbed wire, board, and electric. In some areas of the United States rails, stones, and hedges have been used as fences. A combination of these may be used. The basis for determining the kind(s) of fence(s) to build is as follows:

1. Type of livestock;
2. Classes of livestock that will be confined together;
3. Closeness of animal confinement;
4. Available financing; and
5. Expected life of fence.

5. PLANNING WATER FACILITIES FOR LIVESTOCK

All classes of animals need water for the essential body processes (removal of waste, regulation of body temperature, and digestion and absorption of food nutrients). An animal can go a much longer period of time without food than it can without water. Since water is essential for animal growth and development and can normally be supplied at a fraction of the cost of other nutrients, an adequate supply should be made available to animals at all times.

The three factors having the greatest influence on the amount of water consumed by animals are weather conditions, amount of moisture in the feed the animal is eating, and whether or not the animal is lactating. Animals consume more water in warm or hot weather. Also, lactating animals require more water. In addition to their body requirements for water, 3½ to 5½ pounds of water are required for each pound of milk produced.

WATER REQUIREMENTS FOR DIFFERENT CLASSES OF ANIMALS

Animal	Daily Water Requirements (Gallons)
Dairy Cow, High Producing	Up to 35
Dairy Cow, Dry	12
Dairy Animal, Growing	6 - 10
Beef Cow, Lactating	20 - 30
Beef Cow, Dry	8 - 12
Beef Animal, Growing	6 - 12
Sow and Litter	4 - 6
Boar, Mature	4 - 5
Pig, Growing	½ to 1½ for each 100 lbs. of body weight
75 to 125 lbs.	½ - 2
125 lbs. to Market	1½ - 3½
Mare, Lactating	12 - 20
Horse, Mature	8 - 14

Ewe, Lactating	3 - 6
Ewe, Mature	2 - 3
Lamb	½ - 1
Chicks (100 head)	
1 to 4 weeks	2
5 to 8 weeks	5
9 to 12 weeks	10
Laying hens (100 head)	5 - 10

Such factors as climate, class of animal, production method, cost, availability of water, present water system, sanitation, disease, and insect control should be considered in determining the water system to use. If the producer is to obtain maximum production, an adequate supply of clean water must be readily available.

6. PLANNING FEEDING FACILITIES

Feed is one of the largest single expenses in any livestock operation. Proper facilities for storing and handling can greatly reduce waste and spoilage and, in turn, expenses. Storage facilities should be large enough to handle feed amounts consistent with the operation size.

Storage buildings and feeding facilities should be located and arranged so that the movement of feed from storage to livestock is the shortest distance possible. As many labor saving devices as is economically feasible should be installed.

Feeding systems should be carefully planned to assure that all livestock have sufficient feeding space. The number of animals to be fed, type of ration, availability of labor, and equipment cost are all important considerations in the planning process. Storage and feeding facilities should be accessible to trucks and other equipment. Space is required to maneuver trucks and other motorized equipment.

SUGGESTED STUDENT ACTIVITIES

Complete the following statements:

1. Livestock buildings should be constructed to provide (1) _____, (2) _____, and have (3) _____.

2. Four elements affecting the labor requirement for using a building are (1) _____, (2) _____, (3) _____, and (4) _____.

3. Two factors affecting flexibility of a building are (1) _____, and (2) _____.

4. Lighting may be provided in a building by using (1) _____, (2) _____, (3) _____, and (4) _____.

5. Many disease problems can be prevented in buildings by providing adequate _____.

6. Some types of fencing fabrics are (1) _____, (2) _____, and (3) _____.

7. Some considerations in determining land requirements for a livestock enterprise are (1) _____, (2) _____. and (3) _____.

8. One of the most important management tools in a livestock enterprise is _____.

9. The three factors affecting the amount of water an animal consumes are (1) _____, (2) _____, and (3) _____.

True or False; Circle the correct answer.

T F 10. Fences should follow the crest or natural waterline division in terraced areas.

T F 11. The land capability class is not important in planning fences.

T F 12. An animal can go a much longer period of time without food than it can without water.

T F 13. Fencing priority should be given to boundary fences.

T F 14. One of the largest single expense items in any livestock enterprise is feed.

T F 15. The first step in planning fences is to estimate the amount of materials needed.

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